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  2. memory mapped to a file

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- These issues are magnified in fine-grain threading.

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- This call creates a shared memory pool, but *does not give your process access* to that pool of memory. The shared memory has not yet been attached to your process' (virtual) memory space.

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- After fork(), the child inherits the parent's attached shared memory segments.

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Configuration	ptrdiff_t usconfig(int,...)
Initialization	usptr_t *usinit(const char *)
Allocation	void *uscalloc(size_t, size_t, usptr_t *)
	void usfree(void *, usptr_t *)
	void *usmalloc(size_t, usptr_t *)
	void *usrealloc(void *, size_t, usptr_t *)
	void *usrecalloc(void *, size_t, size_t, usptr_t *)

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- So, with semaphores:

```
sops.sem_num= 0;                    // pick a semaphore
sops.sem_op= -1;                    // attempt to decrement the semaphore
sops.sem_flg= 0;                    // block if semaphore can't be decremented
semop(semid,&sops,(size_t) 1);      // "obtain" the semaphore
  shmpool->str1.whatever= whatever; // access the shared memory
  sops.sem_op= 1;                   // increment the semaphore
  semop(semid,&sops,(size_t) 1);    // release the semaphore
```

Shared Memory: deleting it

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- To detach a shared memory segment from your process, use:

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(shmdt detaches/unmaps the shared memory from the process' virtual memory pool)

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- To remove the shared memory from the system, use:

  shmctl(shmid,IPC_RMID,NULL);

  note that this command will not remove shared memory that still has attachments to it

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```
struct shmid_ds {
        struct ipc_perm shm_perm;    Ownership and permissions
        size_t shm_segsz;            Size of segment (bytes)
        time_t shm_atime;            Last attach time
        time_t shm_dtime;            Last detach time
        time_t shm_ctime;            Last change time
        pid_t shm_cpid;              PID of creator
        pid_t shm_lpid;              PID of last shmat/shmdt
        shmatt_t shm_nattch;         Qty of current attaches
          ...                          ...
    }
```

Memory Mapped I/O : mmap()

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offset starting offset in file for the mapping region *(often zero)*
Must be a multiple of the page size as returned by
sysconf(_SC_PAGESIZE)

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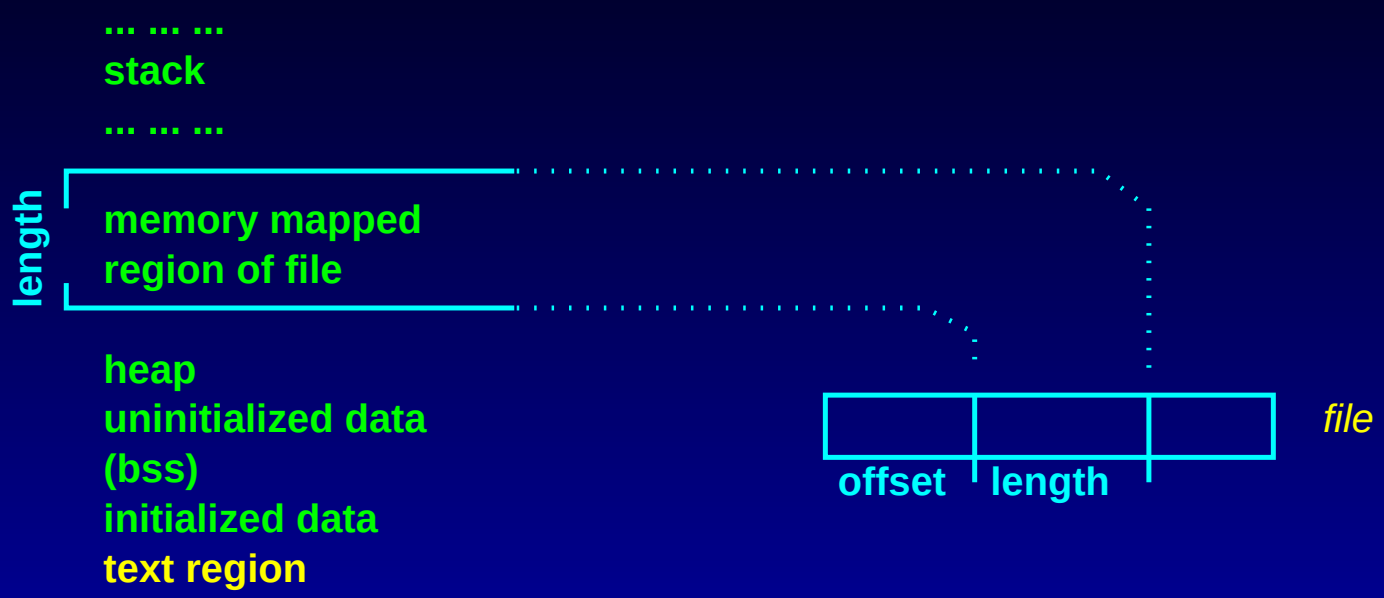
Changes may not actually be updated to the file until msync() or munmap() is called.

Memory Mapped I/O: a picture



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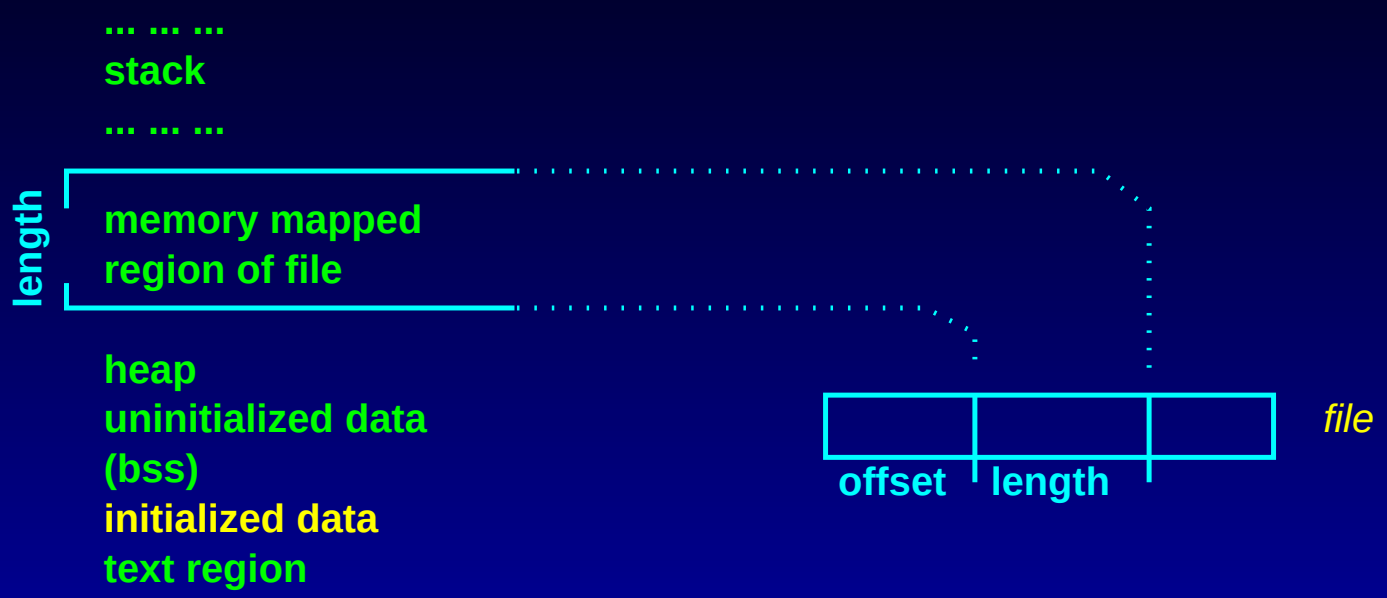

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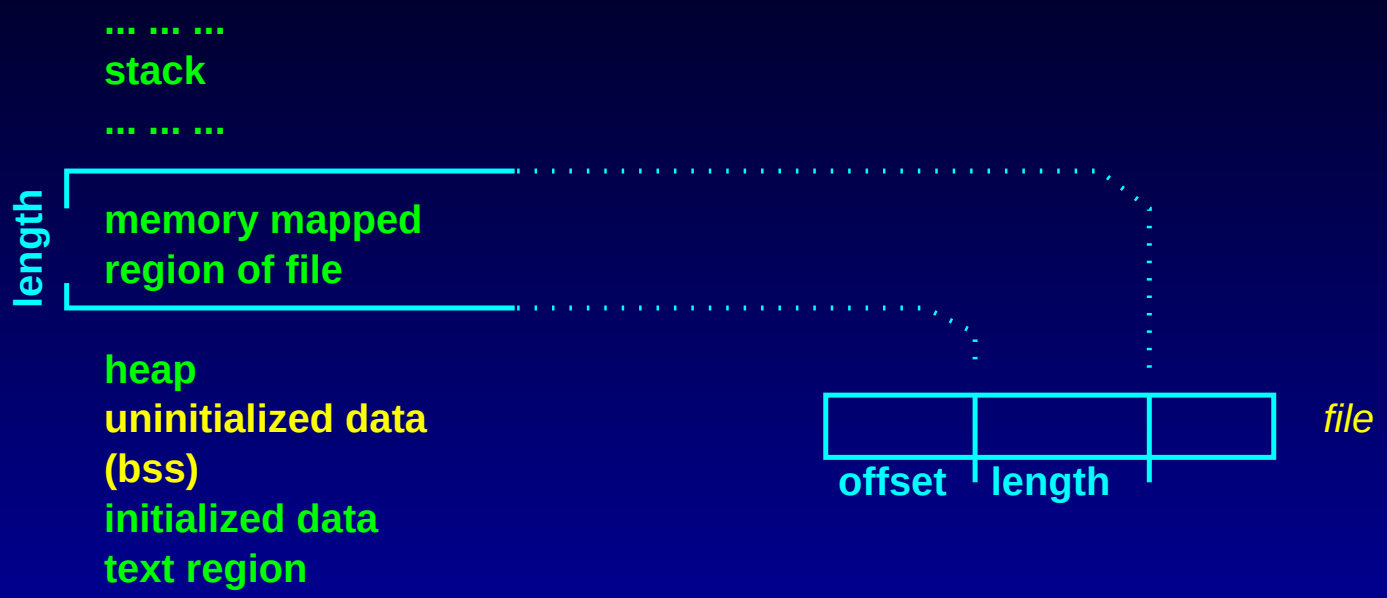

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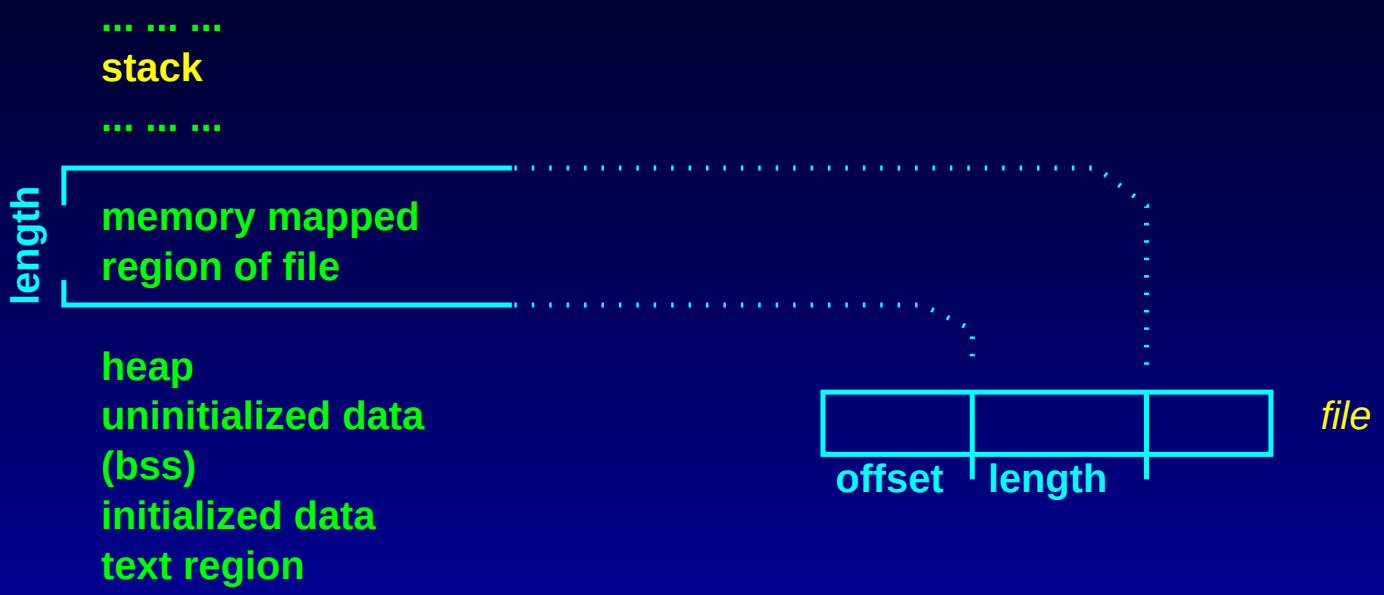

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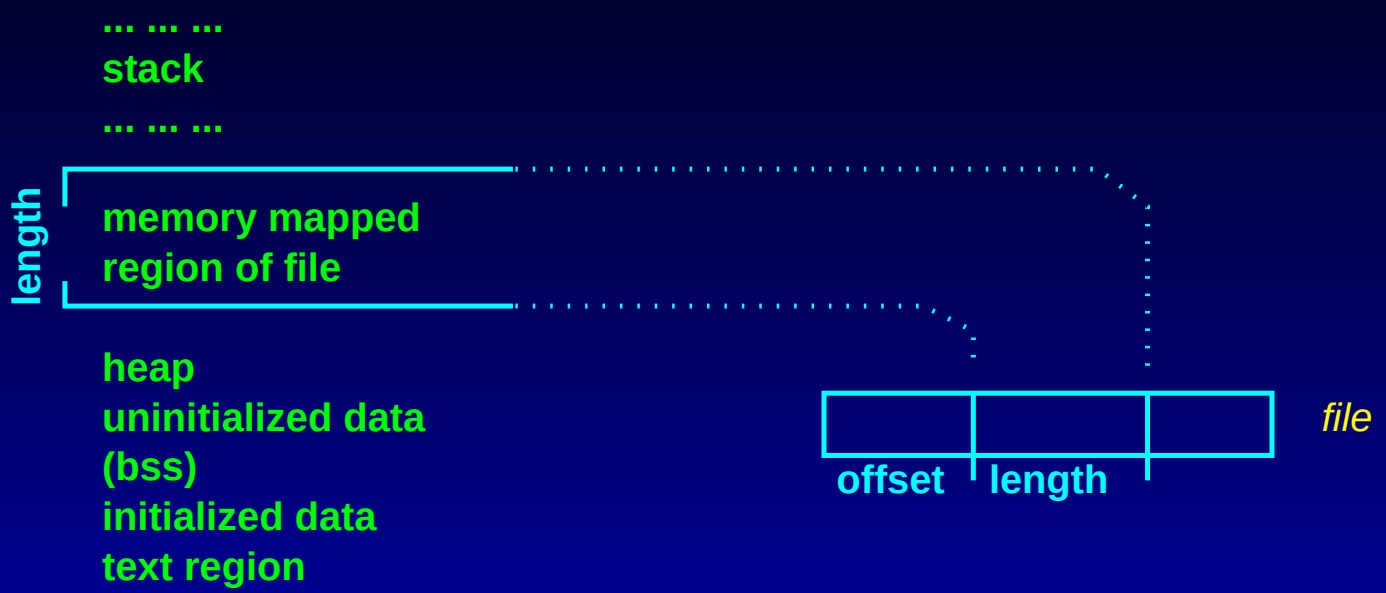

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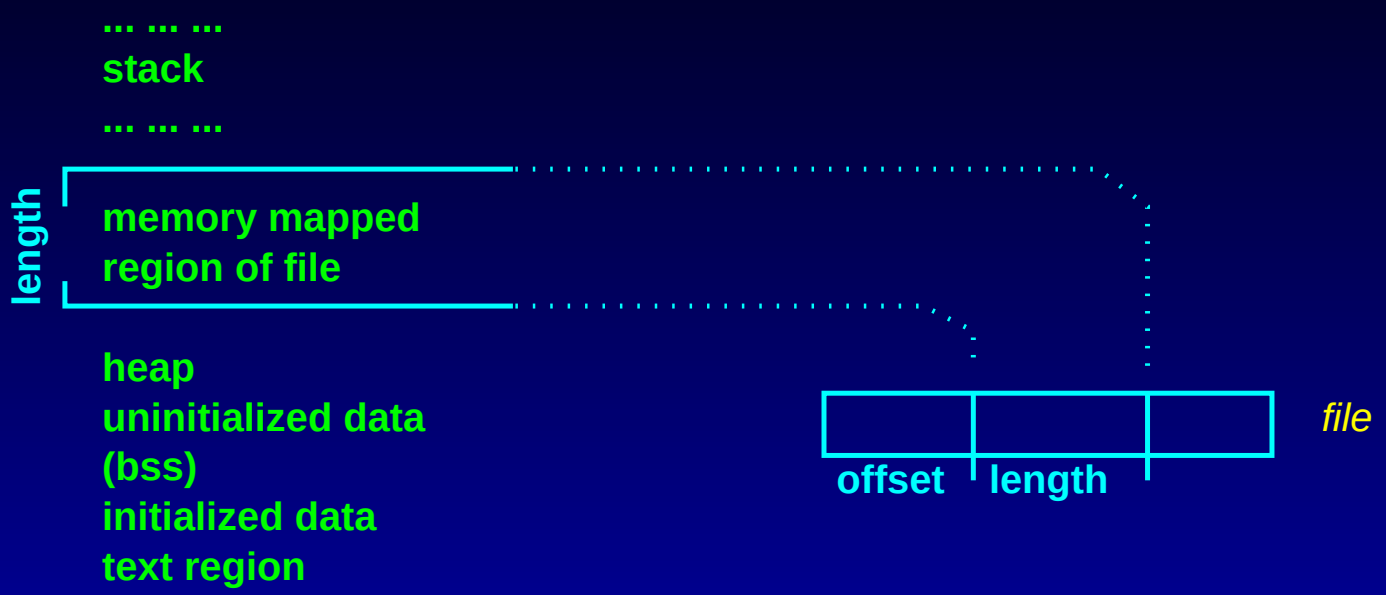

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- mmap() does not do memory allocation
- Newly opened files should be written to at the offset+length-1 byte prior to use (else you'll get a SIGBUS)

Memory Mapped I/O: munmap()

```
int munmap(void *addr, size_t length);
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- Note: closing the file descriptor does not unmap the region!

Memory Mapped I/O: msync()

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Memory Mapped I/O: mlock() and munlock()

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int mlock(const void *addr, size_t len);
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- Locks/unlocks part or all of the calling process' virtual address space into RAM (preventing its being written out to swap memory or hard disk)

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- ipcrm [-Q msgkey|-M shmkey|-S semkey]

  Removes zero or more message queues, semaphore sets, or shared memory segments.